

## 119. TEUTHIS ARGENTEA, Cuv. &amp; Val.

Gunth., Cat. 3, p. 322.—Journ. Mus. Godef. Heft. 7, p. 90.—*Amphacanthus argenteus*, Quoy and Gaim., Voy. Uran. Zool. p. 368, pl. 62, fig. 3.

## 120. TEUTHIS ROSTRATA, Cuv. &amp; Val.

*Amphacanthus rostratus*. Cuv. & Val., Poiss., 10, p. 158.—*Teuthis rostrata*, Gunth., Journ. Mus. Godef., Heft 7, p. 89, taf. 60.

## A MONOGRAPH OF THE AUSTRALIAN APHRODITEA.

BY WILLIAM A. HASWELL, M.A., B.Sc.

[Plates VI.—XI.]

The Australian Marine Annelides have not formed the subject of any special investigations, but scattered notices of Australian species are to be found in the works of Schmarda,\* Kinberg,† Baird,‡ and Quatrefages.§

Of the order to which the present paper is confined the last-named author enumerates and describes six Australian species including those described by Kinberg and Schmarda, and to those Dr. Baird adds five more from among the specimens in the collection of the British Museum. Though the thirty species enumerated in this paper cannot be regarded as a complete list of all the Australian Annelides belonging to this section, yet from the wide extent of coast from which they have been collected, from Torres Straits to Port Western, they may be looked upon as furnishing us with a tolerably correct idea of the general

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\* "Neue Wirbellose Thiere, Band I."

† "Oefversigt af K. Vet.-Akademiens Förhandlingar," 1855, p. 381; and "Eugenies Resa, Annulata."

‡ "Contributions towards a Monograph of the Aphroditacean Annelides." Proc. Linn. Soc., Vol. viii., p. 176.

§ "Histoire Naturelle des Annélés, Vol. I."

facies of this section of the Australian marine fauna. As might be expected from what is already known of the geographical distribution of the Chæthelminthes,\* there is little to markedly distinguish the Australian representatives of this group from those of northern seas; the species are different, but belong to the same or nearly related genera. As regards the distribution of the group within the Australian province itself, the only noteworthy point is that the species of the tropical shores of Queensland are entirely different from those of the temperate coasts of New South Wales and Victoria, a circumstance which affords illustration of the fact that Australia consists, so far as its another marine zoology is concerned, of two entirely distinct provinces—an intertropical or northern, and a temperate or southern, with, on the whole, considering the continuity of the coast line, remarkably few features in common.

A portion of the work on which this paper is founded was carried out last year during a cruise with H.M.S. "Alert" along the eastern coasts of Queensland; and I take this opportunity of placing on record my grateful thanks to Captain J. F. Maclear, Dr. R. W. Coppinger and the other officers of that vessel for much kindness and hospitality experienced during my stay with them, and for assistance liberally rendered in the way of boats and men for dredging when the requirements of the survey permitted.

#### A. ANATOMY AND PHYSIOLOGY.

##### *The Elytra.*

The possession of elytra or scales is one of the most distinctive points in the structure of the *Aphroditacea*. These elytra are flattened squames of varying shape, but always more or less rounded, sometimes delicate and membranaceous, at other times stiff and horny, which cover the back of the annelide in a double

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\* Vide Quatrefages, "On the Geographical Distribution of the Annelida," Ann. Mag. N.H. (3) xiv., 1864, p. 239; also Hist. Nat. des Annélés, t. I.

row. Each elytron is attached to a peduncle or scale-tubercle, the surface of attachment, of circular or oval form, being situated about the centre of the elytron, and the attachment being effected through the medium of a series of muscular fibres, by whose contractions the various movements of the scale are brought about. The elytra are usually attached to every alternate segment—the intermediate segments having as their equivalent the cylindrical dorsal cirri. The dorsal cirri and the elytra may be said to be essentially identical in structure and mode of development. Each consists of an evagination of the integument containing a nerve, the evagination in the one case taking a cylindrical form, while in the other it becomes compressed and scale-like. Such a cutaneous fold ought to contain representatives of the cuticular, the subcuticular and the muscular layers of the integument, and such we find to be actually the case. Each scale contains three principal elements:—(1) an investing cuticle, (2) a double layer of cells or cell-equivalents, and (3) a fibrous layer.

(1). The cuticle varies considerably in its degree of development in different genera and species. Sometimes, as in *Aphrodita* and *Hermione*, it is exceedingly delicate and develops no appendages; sometimes as in *Iphione* and in many species of *Lepidonotus* and allied genera its upper layer attains a considerable thickness and density, and may be variously sculptured on the upper surface; where appendages, such as papillæ or fimbriæ, are present, it forms an investment for them when it does not constitute their entire substance.

(2). The cell-elements representing the subcuticular layer of the integument take the form of a layer of polygonal squames lying immediately under the cuticle. This layer is sometimes transparent—the outlines of the cells being only discernible with difficulty; at other times the cells are charged with pigment granules, a lighter space in the centre being apparently the expression of a nucleus. This double layer of

cells was first pointed out by Ehlers\* in *Polynoë pelluxida*. I have found it in most species which I have examined, though in some cases the outline of the constituent elements were very difficult to trace.

(3). In focussing deeper than the upper layer of cells Ehlers states that he could distinguish a series of dots which he represents as arranged in radiating lines, and which he regards as indicating the existence of some tissue between the two layers of cells. It has been assumed, by Quatrefages, and others, that the scale is simply a flattened sac, between the two walls of which is a cavity communicating with the cavity of the body. The evidence in favour of this supposition is afforded by the fact that in certain species specimens have been observed with all the scales distended and globular, as if blown up by the pressure of fluid from within. I have never seen this phenomenon, which would appear to be of rare occurrence, but it is probably due to a forcible rupture tearing the two layers of the scale apart and producing a permanent malformation. Thus in *Aphrodita* the two membranes of which the scale is composed are firmly united together by fibrous tissue, and require some little force to effect their separation. This fibrous layer is visible in the undissected scale, and is seen still more distinctly when the layers are torn asunder, when the bundles of fibres will be seen curled up on the inner surface. The arrangement of the fibres, which are exceedingly fine, varies in different species; sometimes they are arranged in definite wavy bundles; sometimes the arrangement is quite irregular, the fibres crossing one another in all directions. Morphologically these fibres seem to represent the muscular layer of the integument.

In his account of the structure of the nervous system in *Aphrodita aculeata*† Quatrefages makes no mention of the

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\* "Die Borstenwürmer, p. 109, (1854)."

† Ann. des Sciences Nat. (3me série) t. xiv., p. 362, (1850.)



existence of nerves in the elytra, and their occurrence seems to have been first noticed by Ehleas.† In *Polynoë pellucida* the latter found a nerve entering the scale through the scale-tubercle and giving off radiating branches. A similar arrangement is very well seen in the scales of *Aphrodita* and some species of *Lepidonotus* and *Polynoë*, and is specially conspicuous after strong staining with haematoxylin or cochineal. The nerve divides near the point of entrance into numerous branches which radiate towards the periphery, and become divided again and again, giving off numerous minute twigs. In *Polynoë pellucida* Ehlers has traced each twig to one of the hollow processes on the surface of the scale. This definite termination of each twig may be well seen in successfully stained elytra of other species, and there can be little room for doubt that the papillae on the surface of the scale are, in most instances at least, end-organs for the elytral nerve.

The functions with which the scales may be supposed to be connected are (1) protection, (2) the production of phosphorescent light, (3) sensation, (4) respiration, and (5) incubation.

The *protective* function of the scales is in some instances the predominating one. Thus in *Iphione* the scales are of extreme density and cover the entire dorsal surface with an armour which the animal is incapable of throwing off when irritated, and which gives it a remarkable superficial resemblance to *Chiton*. In others the scales, though tough, are more readily detached, and in some cases they do not completely cover the dorsal surface; while in many species of *Polynoë* they are so delicate, and so readily parted with on the slightest irritation that their direct protective action must be very slight. The greatest reduction of the protective function is, however, met with in *Aphrodita* and some allied genera, in which the scales are covered with a thick layer of matted hairs which form an efficient protective covering to the dorsal surface.

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† L. c., p. 110.

When certain species of *Polynoë* are irritated in the dark a flash of phosphorescent light will be seen to run along the scales, each being illuminated with a vividness which makes it shine out like a shield of light, a dark spot in the centre representing the surface of attachment where the light-producing tissue would seem to be absent. The irritation communicates itself from segment to segment, and, if the stimulation be sufficiently powerful, flashes of light may run along the whole series, one or more of the scales then becoming detached and being left behind still glowing with phosphorescent light. The species characterised by the phosphorescence of their scales are species also distinguished by the celerity of their movements and also by the readiness with which their scales are parted with when the animal is attacked; and it may be that the phosphorescence has a protective effect, the phosphorescent scales thrown off by the annelide distracting the attention of an assailant and enabling the former to make good its escape.

That the scales act, like the dorsal cirri, as organs of some special sense seems probable from their abundant innervation, as well as from the presence in many instances of fimbriæ and other appendages, some of which appear to be the end-organs of the nerve-branches. These appendages, the form of which varies greatly, are processes of the upper wall of the scale, and probably consist of the cuticular, subcuticular, and fibrous layers of the latter; the subcuticular layer is in most instances, however, difficult to make out, owing to the thickness of the cuticle, but in one species of *Polynoë* I find that certain vesicular processes which present a very delicate cuticle shew distinctly below it the layer of polygonal cells, and in the interior a series of fibres which radiate from the base of the vesicle to its outer wall, and many represent the fibrous layer of the scale, or may be of nervous nature.

In *Aphrodita* and *Hermione* the scales have been observed by Williams and Quatrefages to perform an important mechanical

function in connection with respiration. In these genera the dorsal surface is covered with a coating of felted hairs which stretch across from one side to the other, and enclose a canal open in front and behind, and having for its floor the dorsal wall of the body with the elytra and the "branchial" tubercles. These authors regard the oxygenation of the perivisceral fluid as taking place through the thin integument covering the scale-tubercles and the tubercles at the bases of the dorsal cirri, and have observed the scales to be subject to rythmical movements by means of which a current of water is driven constantly over the dorsal surface, thus renewing the water in contact with the "branchiæ." In species in which the felt-like dorsal covering does not exist, this function would appear to be in abeyance; and in *Polynoë* and allied genera, so far as I have observed, the elytra remain perfectly motionless while the animal as a whole is at rest.

When the ripe ova are discharged from the orifices of the segmental organs, they are carried by ciliary action towards the under surface of the elytra, where they remain, adhering by means of a viscid secretion, until they are tolerably well advanced. Impregnation probably takes place while the eggs are in this situation; and I have found still crowding in great masses under the scales, free embryos which had reached the cephalotrochous stage first described by Sars.\*

#### *Segmental Organs and Sexual Glands.*

The position and relations of these organs have been entirely misunderstood both by Williams and Ehlers, and I find their statements repeated in the latest work on general zoology,† so that, though unable to obtain here all the literature of the subject, I am justified in concluding that these errors have not yet been corrected and explained.

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\* Archiv. für Naturg., 1845.

† "Pagenstecher, Allgemeine Zoologie, Band iv."

Ehlers\* in his remarks on the genus *Polynoë* states his opinion that Williams had seen the segmental organs of that annelide only imperfectly and the stages in the formation of the sexual products not at all.† A careful examination of the subject has led me to the conclusion that both of these observers were looking at the same thing from different points of view, but were entirely in error in regarding it as the segmental organ.

At first sight the accounts of the organs in question given by these two observers seem entirely irreconcilable. Williams's description of them is as follows:—"They appear under the character of pyriform tubuli commencing or ending in a single external orifice. Internally they are lined by a ciliated epithelium, the cilia being large, dense, and acting with great force and vigour. The current raised by these cilia sets up on one side and down on the other. The ciliary epithelium ceases at the point where the primary branches divide. All the rest of the organ is unciliated and filled with the reproductive products. This part is elaborately branched,—the branches as formerly stated, twining round the diverticula of the stomach. \* \* \* The individual tubes are bridled on one side and grandular on the other."‡

"The author thinks it probable that if the roots or attached ends of these organs could only be followed through the integuments to their extreme outlets they would be found to divide into two limbs, an ingoing and an outgoing; a fact which would account for the clearly divided ciliary currents as they are seen in the dilated portions of the organs. If this fact of the bifurcation of the tube were clearly determined, there would be no difficulty whatever in connecting the segmental organs of

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\* Die Borstenwürmer, p. 107.

† The words are "Ich zweifle nicht dass Williams die Segmentalorgane nur unvollständig, die Bildungsstätte der Geschlechtsproducte überhaupt gar nicht gesehen hat."

‡ "On the Segmental Organs of Annelids," Phil. Trans. 1858.



*Aphroditea* with their homologues in the typical Annelids. In the absence of *proof*, however, upon this point, they must be described as commencing in a *single tube*, the internal extremity of which divides into a numerous system of branches. None of these branches communicate openly with the cavity of the body."

I have not had the opportunity of dissecting any fresh or well-preserved specimens of *Aphrodita*, but the above account is stated by Williams to apply also to the arrangement of the segmental organs in *Polynoë*, and I find the arrangement in that genus so totally different from that described by Williams, that I have been led to an explanation of Williams's observations and figures which at least reconciles them with what I find to exist in those *Polynoidæ* in which I have worked out this point. In the first place it is to be noted that Williams gives no clue to the position of the external orifice; he admits in fact that he had not been able to follow the canal through the integuments. In the second place, in the figure which he gives of the alimentary canal and supposed segmental organs in *Aphrodita* (l.c., pl. viii., fig. 26) he either has omitted altogether a portion of each intestinal cæcum, or, as I incline to believe, has represented it as the segmental organ. In the third place the figures which he gives of the segmental organ (fig. 27) of *Polynoë* resemble very closely the intestinal cæca in some species of that family when invested by the developing ova, and the position of the orifices relatively to one another and to the middle line answers very well to the position of the apertures of communication of the cæca with the intestine. Further it has to be observed that, were Williams's account to be accepted, we should be obliged to admit that the segmental organs and sexual glands of *Aphrodita* and *Polynoë* are framed on a type *totally unlike* that observed in any other Annelide; he represents the former as complexly branched tubes, not opening into the perivisceral cavity, but opening externally, and the latter as being situated in the interior of the former; whereas in other Annelides the segmental organs are unbranched,



and nearly always open internally into the cavity of the body, and the sexual products are developed in the body cavity by a sort of germination of the lining membrane. Moreover I have found in these species of *Polynoia* whose structure I have specially studied segmental organs not markedly different from those of other Annelides, and sexual glands having the normal relations. It will therefore not be inadmissible to suppose that Williams's representation of these structures must have been founded in some way or other on erroneous inferences. It seems to me most probable that what Williams took for the segmental organ was a part of the dorsal branched portion of the intestinal cæca, and that his ciliated efferent duct was the ciliated neck of communication between the cæcum and the intestine. The intimate manner in which the ovaries are related to those cæca would help to account for this. When he states positively that the ova are most clearly seen in the interior of the branching tubuli, it is evident that he had mistaken the yellow cells for young ova; what he figures as spermatozoa do not at all resemble the spermatozoa of the *Polynoia* which I have studied, and here too there may have been a wrong deduction. Be this as it may, it is perfectly conclusive as shewing that William's descriptions, whatever be their precise explanation, are erroneous, that the fully developed sexual products both in *Aphrodita* and *Polynoë* are found floating freely in the perivisceral fluid, which could not be the case were they formed in the interior of cæcal tubes opening only on the exterior.

While there is some difficulty in explaining Williams's statements on this subject, Ehlers's description and figure on the other hand are so clear as to leave no doubt at all as to the nature of the error into which he has fallen. In describing the anatomy of *Polynoë pellucida* he states\*:—"Segmentalorgane habe ich vom zweiten Segmente an in allen völlig ausgebildeten Segmenten

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\* L. c., p. 116.

gesehen. Ihre Lage haben sie im Hohlraume des Elytrenträgers und des Basalstückes des Rückencirrus und ragen von da in den Segmentalraum unter die Haut der Rückenfläche hinein. Der wesentliche und grösste Theil des Segmentalorganes (Taf. iv., fig. 3) ist ein fast die ganze Höhlung des Elytrenträgers oder Basalstückes des Rückencirrus einnehmender Sack, dessen Wand in sehr unregelmässiger Weise zu halbkugeliggeformten Ausbuchtungen vorgewölbt ist. Ich maass als grösste Längsdehnung dieses Sackes 0.55 mm. bei einem Dickendurchmesser von 0.3 mm. Dieser Sack setzt sich in den Raum des Segmentes hinein mit einer cylindrisch ausgezogenen Verdünnung, dem Halse des Segmentalorganes, fort. und auf dem Ende dieses Halses der unter der Rückenwand des Körpers liegt, steht umgeben von einem etwas aufgewulsteten Rande die innere Öffnung des Segmentalorganes, an denen Eingänge hier ein Kranz von Kurzen Wimperhaaren in lebhaft rädernder Bewegung ist. Der Durchmesser dieser inneren Öffnung betrug in einem Falle 0.027 mm., in einem anderen 0.11 mm., Unterschiede welche vielleicht auf Rechnung eines wechselnden Contractionszustandes zu schieben sind. \* \*

Ich habe bereits erwähnt dass auf der Oberfläche des Elytrenträgers Wimperrosetten in verschiedener Anordnung vertheilt seien, das gleiche gilt vom Basalstücke des Rückencirrus. Diese Wimperrosetten stehen um kreisförmige Öffnungen, die äusseren Mündungen des Segmentalorganes; denn cylindrische Röhren gehen von der Oberfläche des Sackes ab zur Wand des sie bergenden Gliedes, durchbohren diese und münden dann an den mit den Wimperrosetten ausgezeichneten Öffnungen." \* \* \*

“ Die Wand des Segmentalorganes ist ziemlich dick, zumal im Halse; in den vorderen Körperringen war sie meist hell und farblos, in den hinteren bekommt sie dagegen im Sacke selbst eine gelbe Pigmentirung, indem hier auf ihrer Innenfläche so gefärbte Kugeln einer Kornigen Masse von 0.0216 mm. Durchmesser aufgelagert sind; die Wand des Halses wie der Ausführungsgange war auch hier farblos und hell. Eine wichtige

Erscheinung beobachtete ich an dem Sacke, das ist seine Contractilität, welche vielleicht durch Elemente musculöser Natur, die der Wand eingebettet sind, veranlasst wird \* \* \* In einem Falle bestand der Inhalt der Segmentalorgane aus blasenähnlichen Körpern, von 0·012—0·024 mm. Grösse, die fettartige Körnchen enthielten; sie bildeten an der Innenfläche des Sackes eine ungleichmässig vertheilte Masse, die bei auffallendem Lichte weiss aussah."

Two species of *Polynoë* which occur in Port Jackson—viz., *P. (Antinoë) præclara* and *P. (Antinoë) Wahlii*—seem to be near allies of *P. (Antinoë) pellucida*. In these the intestinal cæca (Pl. vi., fig. 1.) consist of a ventral portion, which is a rounded non-contractile sac, and a dorsal portion which is contractile, sometimes with a regular rhythm, and is also undivided externally (though internally partitioned), but presents rounded elevations of its outer wall. The latter portion occupies the cavities of the scale-tubercles, the bases of the dorsal cirri, and the bases of the parapodia. They are found from the second segment backwards, though not in all the segments of the anterior region of the body. These cæca are connected with the alimentary canal by a ciliated neck, which is very long in the anterior segments and very short behind, and the opening into the alimentary canal is funnel-shaped and thickly ciliated. The cæca are connected with the walls of the parapodia by bands of muscular fibres. In the anterior segments they are almost colourless; behind their walls are of a bright golden yellow owing to their containing numerous yellow cells.

Ehlers' drawing (l. c., taf. iv., fig. 3.) is a very faithful representation of one of these cæca as seen in *Polynoë præclara* save that the internal orifice of the supposed segmental organ is represented as opening into the body-cavity instead of into the intestine, and the bands of muscular fibres connecting the cæcum with the walls of the parapodium in the neighbourhood of the

rosettes of cilia are represented as canals leading from the cavity of the cæcum to the exterior.

The true position of the segmental organs of *Polynoë* is very different from this. On the ventral surface of the body close to the base of each parapodium is a smooth elevation, the integument of which is very richly provided with vermiculate and flask-shaped subcuticular glands. At the posterior and external angle of this elevation is a process, the ventral tubercle. The only statement which I have met with regarding the nature of this tubercle is a conjecture by Prof. Huxley (*Anat. of Invert.* p. 231), that it may possibly be connected with the reproductive function. It is of varying shape; in some species short and vase-like with longitudinally folded walls; in *Antinoë præclara*, *A. Wahlii* and *Thormora argus*, in which I have studied it more specially, it is a cylindrical, smooth, cirriform process, sometimes a third of the length of the ventral cirrus. It is traversed by a canal with dilatable ciliated walls, which opens at its extremity either by a rosette of several mouths or by a single orifice. This canal is continued from the base of the process inwards and slightly forwards and ends in the body cavity at some distance from the middle ventral line. The walls of this inner portion of the canal are glandular and contain reddish-yellow bodies, some of which may, on the application of slight pressure, be seen to pass out through the external aperture. These bodies are of a quite different appearance from the concretions observable at the bases of the tentacles and cirri, they are clearer, browner and seem to be semifluid. Of the form of the internal extremity of the canal I did not succeed in satisfying myself; but there is no doubt that it opens freely into the perivisceral cavity. I found in one specimen spermatozoa in the act of being discharged through this canal. They passed along the canal by the action of the cilia in considerable numbers, and were driven into the outer portion, which became in some cases slightly distended with them, and passed gradually out at the external orifices. In the female the



processes are shorter, and their aperture simple and wider than in the male. I have never succeeded in finding ova in the act of being discharged, but there can be no doubt that they pass out by the same channel as the spermatozoa. The ova are extremely viscous and very readily pass under the influence of a slight pressure through an aperture much smaller than their ordinary diameter. As already noticed, the ova in *Polynoë* undergo the earlier stages of their development on the dorsal surface of the mother under the protection of the elytra. In specimens of *Antinoë præclara* with matured sexual elements, the ventral border of the base of the parapodium was provided with a line of very long cilia, which curved round to the base of the ventral tubercle and acted in such a manner that anything that might be discharged through the ventral tubercle must have been driven upwards towards the dorsal aspect; both sides of the fissure between adjacent parapodia were likewise clothed with similar, though shorter cilia, the action of which was such as to receive and carry upwards to the cavity beneath the elytra any light objects driven within their reach by the first set. The object of this arrangement would seem to be to carry upwards the ova, when discharged, to the shelter of the elytra.

Apertures have sometimes been described as occurring in the walls of the parapodia in *Polynoë*, and through these it has been supposed that the sexual products are discharged. Such apertures do not occur in any species I have examined for them; short rows and rosettes of cilia often occur; these are always set in recti-linear or circular slits in the cuticle—the cilia being prolongations of the subcuticular layer—and in the case of the rosettes this may produce the appearance of circular apertures. I can only speak with certainty, however, of the absence of these apertures in the species I have examined, during the breeding-season; it may be that at that time apertures which exist at other seasons are closed to prevent the sexual products from escaping by any but the proper channels and thus being lost.



But, however this may be, it is not of very much consequence to the present question, namely, the true position and relations of the segmental organs.

As regards the position of the sexual follicles: in *Thormora* and *Polynoe* I have found the ova to be developed in the bases of the parapodia around the intestinal cæca, and the muscular bands passing from the latter to the body-wall, or along the middle ventral line around the ventral vessel. A representation of the developing ova is given in plate vi., fig. 5. They arise from nuclei formed in a membrane covering those parts, which membrane seems to be merely a modified portion of the peritoneum, and probably these "ovaries" are only temporary structures, and not to be detected save during the season of sexual activity. The matured ova when set free float freely in the fluid of the perivisceral cavity and afterwards collect into clumps, two in each segment, situated a little internally to the bases of the parapodia. Such as fail to be discharged subsequently undergo a process of degeneration, lose their full, rounded contour, become crenated or mulberry-like, and probably finally become broken up and absorbed.

The spermatozoa are formed in follicles which are situated, like the ovaries, either along the middle ventral line of the body (pl. vi., fig. 3) or around the intestinal cæca. Each follicle in *Polynoe præclara* is a lobed mass situated in the interval between two segments; along the axis of the follicles runs the ventral pseudohaemal vessel; in *Thormora argus* they are vermiform bodies situated between the branches of the gastric cæca in the lateral portions of the perivisceral cavity. The spermatozoa themselves are rod-like with a slightly thickened head in *Antinoë*, oval in *Thormora argus*. Further observations are necessary for a thorough understanding of the mode of development of these and of the ova.

*The Intestinal Cæca.*

These correspond in number with the segments, except that some of the anterior segments are commonly devoid of them, and a few of the posterior cæca are usually rudimentary. On account of the presence of the elongated gizzard, the cæca corresponding to the anterior segments are connected with the front portion of the intestine by greatly elongated necks, and thus assume a different form from that displayed by the rest. Taking one of the cæca from the middle of the intestine we find it to consist (1) of a narrow neck, (2) of a dorsal portion, and (3) of a ventral portion. The neck communicates with the cavity of the intestine by a funnel-like aperture, immediately around which the intestinal cilia are much longer than elsewhere. It is ciliated internally, and is subject to peristaltic contractions synchronous with those of the dorsal portion of the cæca. In structure its walls resemble those of the intestine. The neck leads into the dorsal portion of the cæcum, which winds round behind the dorsal muscles, and ends in close relation to the dorsal integument. From this opens the ventral portion, which bends downwards towards the ventral body-wall. This ventral portion is never branched; its walls are similar to those of the intestine, and it is usually found to be distended with opaque matter—evidently food undergoing the process of digestion. The dorsal portion is in some genera (*Aphrodita* and *Iphione*) complexly branched—the terminal branches being lodged in the interior of the scale tubercles and the bases of the dorsal cirri. In other forms (*Thormora*), it is simply divided into two or three branches, and in others (*Polynoë*), it is practically undivided, presenting merely irregular elevations. (pl. vi., fig. 1.)

When simple and sac-like the dorsal cæcum is divided internally by incomplete septa, which are prolongations inwards of the wall of the cæcum, consisting of muscular and connective tissue, with a few spindle-shaped nuclei. The interior of the cæcum is lined here and there with “hepatic cells.” These are large spherical

or oval cells with a delicate but distinct cell-membrane and golden-yellow, oil-like contents, with a nucleus, or, more frequently, two or three. It seems very likely that there is a delicate cuticle lining this layer of cells internally, but I have not been able to demonstrate it; it must be very delicate, as a very slight pressure is sometimes sufficient to cause the yellow cells to break loose into the cavity of the cæcum, and pass along into the intestine.

Among these yellow cells are a number of cells (pl. vi., fig. 2.) of about the same size, but of a very different character. Each consists of a delicate, transparent cell-wall, enclosing a varying number of smaller cells, each of which again consists of a delicate transparent sac enclosing a spherical green body, which varies in size in different cells, but is always considerably smaller than the enclosing sac, leaving around it a transparent space. The central green corpuscle appears homogeneous, and may be of an oily nature. The nature of these cells remains somewhat doubtful; but they are most probably early stages in the development of the yellow cells. They usually occur distributed pretty regularly among the yellow cells, so as to produce an appearance of dark mottling in the otherwise yellow cæca. More rarely they are so numerous as to give the whole cæcum a dark appearance.

The principal functions of dorsal portion of the cæca are undoubtedly secretory; they are to all intents and purposes secreting glands, never being found to contain food-particles. The secretion consists of the contents of the yellow cells, and is driven out by the action of the cilia and by the peristaltic contractions to which the cæca are subject. The ventral portions of the cæca are most probably the principal seat of the digestive and absorptive processes; the tube of the intestine itself is seldom found to contain food in specimens that have been kept for a short time in clean water.

Eisig\* has recently published an interesting and thorough account of what he calls a swimming-bladder-like organ in the *Hesionidae* and *Syllidae*. In his account of the homologous structures in other groups he makes no allusion to the cæca of the *Aphroditacea*; but the closeness of the correspondence between the latter and the organs which he describes leaves no room for doubt that they are homologous, and to some extent, analogous structures. Eisig† regards the principal function of the "swimming-bladder" as being to store up the oxygen separated from the sea-water by the intestine and to serve it out as required. The forms in which he regards this intestinal respiration, with the presence of air-bladders as storehouses for the oxygen, as being best marked are also, he points out, forms in which there are no branchiæ; they have, however, a specially well-developed vascular system, and in this respect present a contrast to most *Aphroditea*.

The chief circulatory medium in the *Aphroditea* is the perivisceral fluid — the pseudohæmal system being but slightly developed. The circulation of the former is very actively kept up by the energetic action of the numerous long cilia in the cavities of the parapodia. This active circulation would seem to show that in this family the perivisceral fluid serves not only as a passive supporting "connective fluid," but is the chief medium through which the gaseous interchanges involved in respiration are brought about; and this view of its function is strengthened by the fact that gills in the sense of delicate processes of the body-wall supplied by vessels of the pseudohæmal system are, (except perhaps in *Sigalion*), entirely absent. The tubercles which bear the scales, together with certain elevations which occur in some genera in a corresponding position on the segments which do not bear scales, have not uncommonly received the name

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\* "Ueber das Vorkommen eines schwimmbblasenähnlichen Organs bei Anneliden. Mittheilungen aus der Zoologischen Station zu Neapel, " Band II., pp. 225-304, pls. xii.-xv., (1881).

† L. c., p. 286.



of "branchiæ." Here the integument is usually rather thinner than in other parts, and is often free from pigment; in *Aphrodita* and *Iphione* it is perfectly transparent. These tubercles are occupied, as already described, by the terminal portions of the dorsal cæca, which curve round above the dorsal muscles, so as to lie in close contact with the integument. The peculiarity of this arrangement was remarked upon long ago by Williams.\* He remarks that the perivisceral fluid must be the chief medium for the conveyance of oxygen to the tissues, and expresses the opinion that the object of the peculiar arrangement of the cæca is to bring about more effectually the oxygenation of their contents, which are then, in *Aphrodita*, absorbed by the vessels of the true vascular system. The contents of the cæca in that genus he describes as consisting of a greenish chyle. Quatrefages has put forward a similar theory as to the function of the cæca, and classes the *Aphroditea*, as regards their mode of respiration, with the *Æolidæ* and *Cæloenterata* as "phlebentèriens." In *Polynoë*, in which the relationship of the dorsal portion of the cæca to the integument is by no means so close as in *Aphrodita*, in which the integument of the dorsal tubercles and bases of the parapodia is not in any marked degree thinner than that covering the rest of the body, and in which there is no special arrangement for driving a current of water over the dorsal surface, it is probable that the process of respiration, though taking place in part through the external skin, is also partly carried on by some other means. It seems highly probable in fact that we have here another instance of intestinal respiration, and it is quite possible that the dorsal cæca may act, as the swimming-bladder is supposed to act by Eising, as a reservoir for oxygen or oxygenated water, or may themselves act as respiratory organs. I have never found these cæca to contain free gas, though bubbles may occasionally be found in the intestine itself, so that it does not seem likely

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\* British Annelida, Report of the British Association, 1851, p. 200.



that the cæca possess the hydrostatic functions ascribed to the swimming-bladder of *Hesione*.

### *The Pseudohæmal System.*

The principal trunks of a pseudohæmal system were observed by Treviranus in *Aphrodita*, and the vessels in that genus were also noticed or described by Williams, Quatrefages and Selenka. In the *Polynoina*, however, Claparède states that vessels are altogether absent, and this statement is confirmed by Huxley (Anat. of Invert.) as regards *Polynoë squamata*. I have found a pseudohæmal vascular system in five of this family, viz.:—*Antinoë Walii*, Kinberg, *Antinoë præclara*, mihi, *Antinoë ascidiicola*, mihi, *Polynoë ochthæbolepis*, mihi, and *Thormora argus*, Baird. It presents dorsal and ventral contractile trunks, the former, which is rather the larger, running along the middle line close under the dorsal integument as far as the posterior termination of the retracted gizzard; the latter lying close above the nerve-cord and running in the axis of the testicular or ovarian follicles, when these are present.

In *Antinoë præclara* the dorsal vessel turns over to the left, opposite the hinder end of the retracted gizzard and runs forward parallel with the left border of the latter till it reaches the head where it turns in again towards the middle line. The direction of the peristaltic contractions is from behind forwards in the dorsal vessel. Both dorsal and ventral vessels give off lateral transverse branches corresponding in number to the segments. All the vessels, even the principal trunks, have extremely delicate walls and their contents are perfectly colourless, and these characteristics may account in many instances for the failure to detect their presence. In one case I observed in the fluid amorphous, transparent, colourless corpuseles. In *Thormora argus*, which possesses a very opaque integument, through which no trace of vessels can be seen, transverse sections reveal the presence of pseudohæmal trunks; and it is not unlikely that a

careful investigation will reveal their presence in most, if not all, members of the family.

B. CLASSIFICATION.\*

FAM. APHRODITACEA.

Genus APHRODITA, Linn.

*Aphrodita australis*.

*Aphrodita australis*, Baird, P.L.S., vol. viii., p. 176.

Body ovate, oblong,  $3\frac{1}{2}$  to 4 inches long, and from  $1\frac{3}{4}$  to 2 inches broad, narrower posteriorly, convex on the back, which is covered with a thick felty substance, consisting of a thinnish membrane and numerous fine hairs matted together, concealing the elytra; head-lobe small; tentacle very short; palpi of considerable length, yellowish. Feet-bearing segments of body 42, feet 42 pairs, biramous, ventral branch strong and much corrugated, obtusely rounded at extremity, inferior cirrus rather strong and of considerable size. Bristles of this branch strong, of a bronzed colour, simple, disposed in two fascicles, of which the inferior are short and lighter coloured, the superior much stronger and not numerous. Upper or dorsal branch of feet furnished with two fascicles of bristles: the lower consisting of very numerous, simple and slender hairs, presenting, as in *A. aculeata*, an iridescent fringe along the sides, but not nearly so beautiful as in the European species, being more of a bronzed metallic hue. The upper fascicle of bristles penetrate the felty covering, and lie down on the back. They are very long, each being at least 14 lines in length. They are of a pale colour with a slightly metallic hue, become slender at the extremity and are simple. The dorsal cirri are stout, setaceous and white. The ventral surface of the animal is brownish and rough, with very numerous, small points or projections. [*Baird.*]

Port Lincoln; Port Stephens; Port Jackson; Tasmania.

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\* The arrangement followed is that of Kinberg.

This species is, as remarked by Dr. Baird, the representative in Australian seas of the European Sea-Mouse (*Aphrodita aculeata*). I have only had the opportunity of dissecting one specimen of this species, and that a very old spirit-specimen; but there seems to be little, if any, material difference in the internal structure. The form and arrangement of the intestinal cæca, the enclosure of the dorsal portions in the transparent dorsal tubercles, forming the so-called "branchiæ," and the structure of the nerve cord are precisely similar.

The Australian Sea-Mouse does not seem to be by any means so common as its European congener; but this may be due to the operation of trawling not being carried on by Australian Fishermen, as the majority of the specimens obtained on the English coast are got by this means, or from the stomachs of fishes obtained by deep sea-lines.

*Aphrodita Terræ-Reginæ, sp. n.*

The body of this species presents 38 segments, elytra being present on the first, third and every alternate segment. The head is small and covered by the front pair of scales. The tentacles are about  $\frac{1}{4}$  of an inch in length, smooth, tapering. The scales are delicate, semitransparent and covered by a thick matting of felted hairs. The dorsal cirri are very long and slender; the ventral very short, tapering, not reaching to near the extremity of the ventral setæ. The ventral surface is minutely tuberculated. The ventral setæ are about half a dozen in number in each parapodium, brown, short, rather stout, slightly curved at the tip without serrations or teeth. The dorsal setæ are very yellow, stout, rather flexible, about  $\frac{1}{4}$  of an inch in length, straight and unarmed.

Dredged near Cape Flinders, Northern Queensland, at a depth of a few fathoms.

## Genus HERMIONE, Blainv.

*Hermione brachyceras* *sp. n.* (Pl. VII., figs. 1—3.)

In this species the setiferous segments are 32 in number and the elytra 15 pairs. The præstomium is small and the mesial tentacle is a very short and stout process; the buccal tentacles on the other hand are very long, geniculate, cylindrical and tapering; around their bases are a series of short processes. The first body-segment has a small parapodium with short setæ and a long slender ventral (tentacular) cirrus. The neuropodia and notopodia are distinct, the former are long and narrow, the latter much shorter and wider; and the ventral cirri are very short. The notopodia, as in most species of the genus are divisible into two sets in accordance with the arrangement of the setæ; in the second, fourth, and every alternate segment the setæ are few,  $\frac{1}{18}$ ths of an inch in length, pointed at the extremity and provided with a double row of obscure serrations; in the third, fifth, and every alternate segment the setæ are much more numerous, and are arranged in two series, of which the inner, to the number of six, lie flat on the scales, while the outer, to the number of about a dozen, are directed upwards and backwards, and are quarter of an inch in length; the setæ on the second set of parapodia are pointed and mostly provided with a double series of conspicuous barb-like teeth; a few, however, are simple and very slender. The ventral setæ, which are only three in number in each parapodium, are stout, nearly  $\frac{1}{10}$ th of an inch in length, bifurcate near the extremity, one branch being short and broad, while the longer branch bears a denticle near its apex. The elytra are delicate, colourless and translucent. The ventral surface and the parapodia are papillose. The length is  $\frac{7}{8}$ ths of an inch, and the breadth  $\frac{1}{4}$ th of an inch.

One specimen of this species was obtained on a coral reef in Port Molle, Whitsunday Passage, during the surveying cruise of H.M.S. "Alert." Its nearest ally appears to be *H. Mathei* of Quatrefages from the Isle of France.



*Hermione Macleari, sp. n.*

The head of this species is small and entirely concealed by the anterior scales and dorsal setæ. The mesial tentacle is small, very slender, and has a slight enlargement near the extremity, followed by a thin tapering apical portion which again ends in a very slight knob. The buccal tentacles are about twice the length of the mesial, and of similar shape. The body consists of 39 segments, with 14 pairs of elytra. There are no barbed setæ on the parapodia. The dorsal setæ are 15 to 23 in number in each parapodium; they are long, slightly arcuate, trigonous, with a series of denticles on each border, and are arranged in a radiating manner round the apex of the notopodia, the inner ones nearly meeting those of the opposite side across the back. In addition to the setæ the notopodia are provided with a small quantity of flax-like hair. The ventral setæ are four or five in each parapodium, short, bifurcate near the tip, one branch being very short. The ventral cirri are very small, with a scarcely perceptible enlargement a little beyond the middle, followed by a thin terminal portion. The dorsal cirri are larger than the ventral, but of a similar form. The scales are delicate and colourless.

Port Molle, 14 fathoms.

*Hermione (Aphrogenia) dolichoceras, sp. n.* (Pl. VII., figs. 4—7.)

The body contains 35 segments bearing setæ. The head has a very prominent facial tubercle covered with papillæ; the mesial tentacle is broken off near the base, on each side of which is a prominent subspherical eye. The buccal tentacles are extremely long, about a fourth of the length of the body, tapering, non-ciliated. The first pair of parapodia have a few hair-like setæ; the ventral cirri of this segment are longer than the dorsal, about  $\frac{1}{2}$ th of the length of the lateral tentacles, with a club-like apex; the dorsal cirri are slightly dilated near the apex, which is acute. The dorsal cirri of the remaining pairs of parapodia are very long, as long as the breadth of the body, slightly dilated near the apex;



the ventral cirri are very short. The scales are delicate, colourless and semitransparent. The dorsal setæ are partly filiform, partly curved and simple; one or two of them are straight, with harpoon-like teeth near the apex, three on one border and four on the other. The ventral setæ are two in each parapodium, abruptly bent near the apex, with a strong, pointed tooth opposite the bend, and two smaller teeth and a fringe of hairs in the apical portion—the apex acute, slightly hooked. The length is three-quarters of an inch.

Port Molle, 15 fathoms.

This species differs from *Aphrogenia alba* of Kinberg, (*Eugenies* Resa, p. 6, pl. ii., fig. 6.) which it rather nearly resembles, in the much greater length of the lateral tentacles and of the dorsal cirri, and the presence of harpoon-like dorsal setæ.

Genus TRICERATIA, (*nov.*)

Similar to *Hermione*, but with three tentacles on the præstomium and without barbed setæ. Scales covered with a layer of felted hairs.

*Triceratia aræoceras*, *sp. n.* (Pl. VII., figs. 8—13, and Pl. VIII., figs. 1 and 2.)

The body presents 42 segments bearing setæ. The præstomium, which is completely concealed by the scales, is very small and bears three long and extremely slender tentacles, the middle one longer than the lateral, all three with a slight swelling near the extremity. The peristomium is not distinct, but has a pair of long and stout tentacles ornamented with minute papillæ. The first segment of the body has a bunch of flax-like hairs on the rudimentary parapodia, and slender dorsal and ventral cirri. The neuropodia and notopodia of the following segments are distinct; the former have four stout brown setæ,  $\frac{1}{16}$ th of an inch in length, bifurcate at the extremity, one branch being very short and tooth-like. The dorsal setæ are partly directed upwards and

outwards, and partly lie flat on the scales; they are stout,  $1\frac{1}{10}$ th of an inch in breadth, slightly arcuate, pointed, and ornamented with several rows of distant minute tubercles; to the inner aspect of the notopodia is attached the hemp-like hair which covers the scales. The ventral cirri are very small, and consist of a thick proximal, and a slender distal portion. The surface covered with minute papillæ. The scales are very delicate and semitransparent. The total length is about an inch, the breadth about a  $\frac{1}{4}$  of an inch.

Two specimens of this species were obtained with the dredge at a depth of 15 fathoms in Port Mollé. One of these I dissected, and noted the following peculiarities:—

There are no teeth, but otherwise the œsophagus and the major portion of the muscular gizzard (pl. viii., fig. 1) very much resemble those of *Polynoë*; the epithelium (pl. vii., fig. 11) consists of cells filled with granular material, having a tolerably broad base where they abut on the cuticle, but tapering externally into a slender thread; between those slender external prolongations of the epithelial cells are a number of irregularly arranged nuclei and pigment granules. Towards its posterior end the crop becomes much narrower, and the epithelial lining becomes thrown into a series of regular ridges, presenting the appearance shewn in fig. 12, the ridges being separated by furrows in which the epithelial lining is very thin; the cells constituting those ridges (fig. 13), are much longer than in the epithelium of the anterior portion of the crop, but present the same general characters. The anterior portion of the intestine is very wide, and the hinder portion of the crop is completely embraced by it for a little distance. The rest of the intestine, however, is a narrow tube giving off complex cæcal appendages. The cæca (pl. viii., fig. 2) which are given off from the dorsal aspect of the intestinal tube, and begin in the second or third segment, have a long narrow neck, giving off numerous branches, each of which ends in a slight dilation filled with "hepatic" cells.

## FAM. IPHIONEA.

## Genus IPHIONE, Kinberg.

*Iphione ovata*.

*Iphione ovata*, Kinberg, Oefvers Vet-Akad Förh., 1855, p. 383, and Fregat. Eugen. Resa, p. 8, tab. iii., figs. 8, 8a—8e; Quatre-fages, l. c., p. 269; Baird, l. c., p. 181.

Antennæ and cirri ciliated, cylindrical, with a long attenuated apex; bases of the antennæ longer than the cephalic lobe; antennæ shorter than their bases and the cephalic lobe; elytra free from cilia on the margin. Body 12 mm. in length and 7 in breadth, convex above, robust. Eyes placed in the postero-external part of the cephalic lobe; buccal cirri long, half the length of the palpi. Elytra reticulate, the areolets in turn with hexagonal reticulations, obliquely reniform, the outer part broader, minutely tuberculous. Feet uniramous, the dorsal and ventral setæ of the same length. Dorsal cirri short, scarcely longer than the setæ, cylindrical with a long subulate apex; ventral cirri styliform, reaching the apex of the feet, sparsely ciliated. [*Kinberg.*]

A species of *Iphione* very common on coral reefs on the coast of Queensland is seemingly the *I. ovata* of Kinberg. There are a few points of discrepancy between my specimens and the descriptions and figures in the "Voyage of the Eugénie," but they are not of great importance. Thus the thin terminal portion of the outer peristomial tentacles is not nearly so long in my specimens as in Kinberg's figure, and the reticulations on the scales (which are formed of beaded lines) are not nearly so large. I obtained specimens of this species from Port Curtis, Port Molle, Port Denison, and Thursday Island. It was found at Honolulu during the voyage of the Eugénie.

The dorsal tubercles in this species are transversely elongated, and the integument covering them is thin and transparent. The mouth leads into an eversible œsophagus, the walls of which in

the retracted state, are longitudinally folded. Following upon this is the powerful muscular gizzard, which is armed with teeth very much resembling those of *Polynoë*. The intestinal cæca are branched, and though more complex, very much resemble those of *Polynoë* in structure. The ventral ganglionic chain does not present distinct dilatations, but remains, as in many of the order, of tolerably uniform diameter throughout; the cord itself is surrounded by a layer of large ganglion-cells which are not confined in ganglia, but run along the whole length of the cord; here and there they may be seen to give off processes into the interior of the cord.

*Iphione fimbriata*.

*Iphione fimbriata*, Quatref., l. c., p. 271.

Head very small, covered. Antennæ long, dilated towards the apex. Inferior tentacula very stout, very long; upper long, only bifurcate towards the apex. Body composed of 28 rings. Elytra 26; first small, rounded; rest moderate, scarcely decussated in the middle of the back, not reniform, fimbriated on their whole external margin. Upper antennæ very long. Cirri with subulate apices. [*Quatrefages*.]

Torres Straits, [Paris Mus.]

FAM. POLYNOINA.

Genus THORMORA, Baird.

*Thormora Jukesii*.

*Thormora Jukesii*, Baird, l. c., p. 199.

Animal about  $1\frac{1}{2}$  inch long, rather more slender at the anterior extremity, elongated, and of a very dark colour. Antennæ and tentacula nearly of the same length, incrassated a little below the apex, where they suddenly become produced to a fine slender point. Palpi longer than antennæ or tentacle, conical at the base, setaceous at the point. Buccal cirri of about the same



length as the palpi, and, like the antennæ and tentacle, incrassated below the apex, and terminating suddenly in a sharp slender point. Elytra 12 pairs, but apparently small, and leaving the middle of the back and lower portion of the body uncovered. They are of a rounded form, tuberculated on the surface, and ciliated on the external margin. The feet are stout, biramous. Bristles of ventral branch stout, of a yellow colour, somewhat curved near the apex, and a little below the point strongly serrated and striated across. The fascicle of bristles springing from the dorsal branch is composed of two kinds—one numerous, slender when compared with those of ventral branch, straight, acute at the point, and very finely serrated on both sides; the other, slender hairs, longer than the others, very numerous and quite smooth, appearing like a brush of fine hairs intermixed with the bristles. The dorsal cirri are, like the antennæ, incrassated below the apex, and ringed with black, and terminating suddenly in a fine slender point. Ventral cirri of feet setaceous, and reaching nearly to the apex of the ventral branch of the foot. Anal cirri stout, and of the same structure as the dorsal.—[*Baird.*]

The locality of this species was uncertain but it was supposed probably to have been obtained in New Zealand or Australia.

*Thormora argus.* (Pl. VIII., figs. 5—12.)

*Polynoë argus*, Valenciennes; Quatrefages, l. c., p. 247.

Head small, subquadrate, covered. Middle antennæ long, nearly twice the length of the lateral ones. Tentacles very thick, conical, longer than the antennæ. Body composed of 26 thick, broad segments. Elytra (12 pairs) of moderate size, the anterior decussate and imbricate; median and posterior (?) scarcely imbricate, not decussate, rounded, very slightly tuberculated, not fimbriated. Cirri rather long. Appendages, with the exception of the tentacles and inferior cirri, tumid near the acute apex. [*Quatrefages.*]

Port Western.

This species is placed by Quatrefages in his second "tribe" of *Polynoë*, characterised by having the middle of the back not covered by the elytra. He makes the following additional remarks on the species :—"This species is 32-33 mm. in length. Its head is small, nearly square. The median antennæ, long and nearly cylindrical above the basilar portion, is nearly twice as long as the lateral. Both are dilated near the apex. The inferior tentacles are very thick, longer than the median antenna, and simply conical, without terminal dilatation. The body only contains 26 segments, the last being quite rudimentary. The posterior extremity bears four elongated cirri, similar to the median antenna, and proceeding from the two last segments. The other segments of the body are thick and broad. The 2—3 first are entirely covered by the elytra which then become separated behind on the middle of the back, which is naked in all its median portion. It ought to be nearly the same behind to judge from the size of the elytra which remain in the two specimens that I have examined. These elytra are rounded, a little oblong. Their surface is covered in part with small tubercles which are elongated now and then in front into cylindrical mammillæ. There is no trace of fimbriæ."

"The feet are short and thick; the setiferous mammillæ very distinct. The notopodium bears a bundle of numerous, long, curved, smooth, light coloured setæ, directed outwards. The neuropodium has a bundle of less numerous, straight, strong, blackish-brown setæ, of which the extremity is expanded into a curved spatula with strongly denticulated borders and a simple, straight point. The dorsal cirrus is longer than the feet. It is dilated like the antennæ near its extremity. The ventral cirrus, which is very short but thick, is placed near the middle of the ramus."

A species extremely common between tide-marks in Port Jackson is probably the same as that above described.

The ventral setæ in this species (figs. 5 and 6) are 25-30 in number, stout, and of a form very common among the members of this genus; the terminal portion of the seta, namely, is bent back on the rest at a very obtuse angle, and is armed from the bend to near the apex with two rows of slender spines, about a dozen in number in each row, the last being larger than the rest. The dorsal setæ are much more numerous than the ventrals, are about  $\frac{1}{3}$ rd of the thickness of the latter, nearly straight, with an acute apex, and some smooth, while others are ornamented with numerous transverse rows of exceedingly minute spinules. The elytra are dotted here and there on their upper surface with larger and smaller hollow ciliated processes (fig. 8). The præstomial tentacles are nearly always subequal, but vary somewhat in this respect; they and the peristomial tentacles and cirri are ornamented with brown bands.

This is the commonest species of the order in Port Jackson. It is found among beds of mussels both between tide marks and, more rarely, in deeper water. It is of very sluggish habits, and is incapable of voluntarily parting with its elytra, which, when at rest, it habitually holds in an oblique position well off the dorsal surface.

I was at first disposed to identify the species which I here refer to *T. argus*, with *Lepidonotus oculatus* of Baird, but the latter is placed by Baird in the genus *Lepidonotus*, and a distinct genus created for those species which differ, like the above, from the typical species of *Lepidonotus* in having the elytra small and not overlapping across the middle of the back; in other points *L. oculatus* and *T. argus* seem nearly related.

A specimen of what seems to be a variety of this species (figs. 9—11) was dredged by me at Griffiths' Point, Western Port. It differs slightly from the Port Jackson form in the shape of the ventral setæ and other minor points.

## Genus LEPIDONOTUS, Leach.

*Lepidonotus oculatus.*

*Lepidonotus oculatus*, Baird, l. c., p. 184.

Animal about  $1\frac{1}{2}$  inch long, and, including the setæ, about  $\frac{1}{2}$  an inch broad, nearly equal in breadth at each extremity. It is of a light yellow colour.

Head rather small; tentacle and antennæ rather short, of nearly equal length, club-shaped near extremity, which terminates suddenly in a slender point. Palpi stout, conical, setaceous, only a little longer than the tentacle and antennæ. Feet stout, biramous. Bristles of dorsal branch few in number, short, straight, sharp-pointed and finely striated across. Those of ventral branch are more numerous, much stronger, slightly curved at the point, but becoming broader near the extremity, where it is serrated, the teeth of the serrations being long and prominent. The elytra are twelve pairs, rather rounded, extending laterally beyond the body; smooth on the edges, roughly tuberculated on the surface, and near the centre marked with a large round black spot, like an eye. Dorsal cirri of considerable length, incrassated or club-shaped beneath the extremity, which is marked by a black ring and, like the tentacle and palpi terminates suddenly in a sharp point. Ventral cirri nearly reaching the extremity of the ventral branch of the foot, slightly incrassated beneath the extremity which terminates in a fine point. Anal cirri of considerable length, and, like the dorsal cirri, club-shaped near the extremity, blackringed and sharp-pointed. [*Baird.*]

Australia, (Brit. Mus.)

*Lepidonotus striatus.*

*Lepidonotus striatus*, Kinberg, Öfversigt af K. Vet.-Akad., Förhandl, 1855, p. 381; Baird. l. c., p. 183.

*Polynoë striata*, Quatrefages, l. c., p. 227.



Antennæ equal to the tentacle, twice as long as the cephalic lobe, reaching half the length of the palpi, like the rest of the appendages and the dorsal cirri, smooth, cylindrical, attenuated at the apex; elytra 13 pairs, broadly striated; inferior setæ bidentate, serrulate below the apex.

Body about 22 mm. in length, and about six in breadth including the setæ. Cephalic lobe rounded at the sides. Tentacle, antennæ, tentacular and buccal cirri almost equal, smooth, attenuated. Palpi very long, attenuated, smooth. Pharynx exsertile with  $\frac{2}{3}$  equal papillæ. Notopodia little distinct, with a style and short seta serrulate at the apex. Neuropodia strong, the aciculum rather long, the setæ bidentate, serrulate below the apex, with transverse series of spinules. Dorsal cirri longer than the neuropodia, of similar form to the tentacles. Ventral cirri shorter than the neuropodia, slender, acute. Elytra spotted in striæ, seen under a power of 300 diameters to present large oval and angular cells. Posterior part of the body not known. [*Kinberg.*]

Port Jackson (*Kinberg*).

*Lepidonotus Jacksoni*. (Pl. IX., fig. 9.)

*Lepidonotus Jacksoni*, *Kinberg*, Övfersigt af K. Vet.-Akad. Förhandl, 1855, p. 383, *Eugenies Resa*, Annulata, p. 11. pl. iii., fig. 11; *Baird*, l. c., p. 182.

*Polyncë Jacksoni*, *Quatref.*, l. c., p. 223.

Antennæ longer than the cephalic lobe; tentacle much longer than the antennæ which are stout, scabrous, and, like the rest of the appendages and the dorsal cirri, inflated below the apex; ventral setæ deeply serrated near the apex; elytra, of twelve pairs, fimbriated at the margin.

Cephalic lobe rounded, the sides obtusely angulated in the middle, eyes small. Palpi inflated below the apex, thick, with minute cilia. Tentacle longer than the palpi, strongly inflated

near the long apex, smooth. Tentacular cirri shorter than the antennæ. First pair of parapodia long, armed with a few setæ. Buccal cirri long, scarcely shorter than the tentacular cirri, inflated. Notopodia short, with stout, short, whitish setæ scarcely reaching the extremities of the parapodia, numerous, serrulate. Neuropodia with long yellow setæ, a little curved near the apex, with few stout, profoundly serrated spines. Dorsal cirri swollen below the apex, short, smooth. Elytra twelve pairs, granulose, triangular, the margin ornamented with long fringes, with oval or rounded quadrangulate cells. [*Kinberg.*]

Near Port Jackson (Kinberg).

This species occurs in beds of mussels, between tide-marks in Port Jackson. In the specimens I have examined the inner peristomial tentacles are not papillose as in that figured and described by Kinberg.

*Lepidonotus stellatus*.

*Lepidonotus stellatus*, Baird, l. c., p. 185.

The animal is about 8 lines in length and three in breadth. The dorsal surface and elytra are of a somewhat uniform olive-colour. The ventral surface is yellow. Head rather small; tentacle unfortunately destroyed. Antennæ slender rather short; palpi stout, conical, short, about the same height as the antennæ. Feet stout, biramous; bristles of ventral branch longer than those of the dorsal, bidentate at the point and serrated a little below its apex. Bristles of dorsal branch short, straight and serrated throughout their whole length. Dorsal cirri about the length of the feet and bristles, setaceous. Elytra 12 pairs in number, oval, marked across one half with two divaricating rows of pustules. When seen under the microscope each scale is very prettily marked with numerous lucid dots, like stars. The margins are quite smooth, segments of body 26 in number; last segment terminated by two short anal cirri. [*Baird.*]

Australia (Brit. Mus.)

*Lepidonotus Bowerbankii*.

*Lepidonotus Bowerbankii*, Baird, l. c., p. 185.

Animal six lines in length and about two broad. The colour is greyish on the back and yellow underneath. Head, antennæ and palpi much the same as in the preceding species (*L. stellatus*). The bristles of the ventral branch are not bidentate at the point, but are more loosely or longly toothed or serrated below the apex. The bristles of the dorsal branch are slender, and finely serrated and striated across. The elytra are 12 pairs in number, the upper ones nearly round, becoming more ovate as they descend. When seen by the microscope the surface is covered with very minute granulations and the external margin is densely ciliated. They are of a light colour, but speckled all over with light fawn-coloured spots. [*Baird.*]

Australia (Brit. Mus.)

*Lepidonotus melanogrammus*, *sp. n.* (Pl. VIII., fig. 13).)

The body in this species contains 25 segments with 12 pairs of scales. The mesial tentacle is about thrice the length of the head, and is slightly dilated near the apex. The other tentacles are all of about the same length as the mesial, and are all of similar shape, except the inner peristomials, which are stouter than the others. The parapodia are not divided, and there are no dorsal setæ. The ventral setæ are similar to those of *Thomora argus*, with a small tooth near the apex. The anal cirri are situated on a prominent lobe. The elytra, which are situated on the 1st, 3rd, 4th, 6th, and every alternate segment, are rather delicate, smooth, not fringed, marked out into polygonal areae. The cephalic and peristomial tentacles are black, except the bases and the tips which are colourless; the cirri are banded with black; the ventral surface is marked with four rows of brown spots. The scales are dark brown on their free portion, light brown on a subcircular space corresponding to the surface of attachment. The length is  $1\frac{1}{4}$  inch; the breadth  $\frac{3}{8}$ ths of an inch.

A single specimen of this species was obtained with the dredge off Broughton Islands near Port Stephens, at a depth of about 30 fathoms.

*Lepidonotus lissolepis*, *sp. n.* (Pl. VIII., figs. 3 and 4.)

The body consists of 25 setiferous segments with 12 pairs of elytra. The mesial and lateral præstomial tentacles are subequal, slender, tapering, smooth. The peristomial tentacles are nearly equal in length, the inner much stouter than the outer; the outer together with the cirri are slightly swollen near the apex, which is attenuated. The scales (which occur on the 1st, 2nd, 3rd, 5th—21st segments) are smooth, rather delicate, not fringed, of a dark slatey-brown colour, the pigment being arranged in minute dense lobed corpuscles instead of separate granules. The parapodia are not divided. The ventral setæ, about 25 in number, are constructed on a type similar to that exhibited by those of *Thormora argus*, but have a small acute tooth near the apex. The dorsal setæ are slender with spinose transverse ridges assuming the appearance of longitudinal lateral rows of teeth. The length is  $\frac{7}{8}$ th of an inch; the breadth  $\frac{1}{4}$ th of an inch.

Nelson's Bay, Port Stephens, 5 fath.

This species seems to be allied to *L. striatus* of Kinberg, but evidently differs from it in the minute structure of the scales, as well as in the greater relative shortness of the inner peristomial tentacles.

*Lepidonotus simplicipes*, *n. s.* (Pl. IX., figs. 1 and 2.)

The body is composed, like that of the preceding species, of 25 segments bearing 12 pairs of elytra. The præstomial tentacles are subequal, of a shape similar to those of the preceding species and banded, as well as the other tentacle and cirri, with dark brown. The inner peristomial tentacles are very thick, not subulate, brown. The outer peristomial tentacles are equal in length to the præstomials and of similar shape. The anal cirri



are very long. The parapodia are undivided and there are no dorsal setæ. The ventral setæ are on a type similar to that presented by those of *Thormora argus*, but near the apex there is a small tooth which has rather the appearance of a step than of a prominent tooth. The elytra are delicate, not fringed, ornamented with a band of very minute processes near the outer border.

Griffiths' Point, Western Port.

This species comes near *L. striatus*, but is distinguished among other points by the form of the ventral setæ, which in the latter species are strongly bidentate.

*Lepidonotus æololepis*, *sp. n.* (Pl. IX., figs. 3—5.)

There are 25 setiferous segments, with elytra on the 3rd, 4th, 6th, 8th and every alternate segment. The præstomial tentacles are slender, the median nearly twice as long as the lateral; like the other tentacles and the dorsal cirri, they have a slight swelling near the extremity followed by a slender tapering portion. The inner peristomial tentacles are longer than the outer, shorter than the mesial, but longer than the lateral præstomial tentacles, smooth, cylindrical. The outer peristomial tentacles are shorter and more slender than the internal one. The ventral cirri are short and conical, the ventral tubercles conspicuous. The anal cirri are longer than the præstomial tentacles. The parapodia are divided, the neuropodium being much larger than the notopodium. The ventral setæ are about 15-20 in number,  $\frac{1}{1000}$ th of an inch in breadth and  $\frac{1}{300}$ th in length, and are of a type similar to that represented by those of *Thormora argus*; the apex is curved and subacute, and the lateral spines are five or six in number in each row. The dorsal setæ are simple and extremely slender, straight, with the exception of a slight bend near the apex—the thickness being slightly increased at the bend. The elytra are delicate, fringed, and marked with numerous subcircular or polygonal figures. The elytra and the dorsal surface below

them are marked with spots of dark blue, there are bands of a similar colour on the cephalic tentacles, and two dark blue spots on the ventral surface of each segment. Length about  $\frac{3}{8}$ ths of an inch; breadth  $\frac{1}{8}$ th.

I found specimens of this species under stones between tide-marks on Thursday Island.

*Lepidonotus torresiensis*, *sp. n.* (Pl. IX., fig. 6.)

The body contains 25 segments bearing 12 pairs of scales, which are imbricate and decussate. The mesial præstomial tentacle is about twice the length of the head, with a subapical swelling and filiform extremity, as in most of the preceding species; the lateral præstomials are a little shorter than the middle and of similar shape. The inner peristomials are rather shorter than the outer in one specimen, a little longer in another, thick at the base, acuminate at the apex. The outer peristomials are as long as the præstomials and of similar shape. The scale-tubercles are very prominent. The ventral setæ are very similar to those of *L. simplicipes*; the dorsal setæ are short with two longitudinal rows of short spines. The scales are subreniform, thickly, fringed ornamented on the upper surface with a few conical and clavate processes. The colour is light grey, with a darker spot at the point of attachment of each scale.

Dredged off Thursday Island in 3-5 fathoms.

This species seems to resemble *L. Bowerbankii* in some respects, but the presence of a tooth on the ventral setæ distinguishes it from the latter.

*Lepidonotus dictyolepis*, *sp. n.* (Pl. IX., figs. 7 and 8.)

There are 25 segments bearing setæ and 12 pairs of elytra. The præstomial tentacles are nearly equal, inserted in a line, the mesial rather longer, twice the length of the head, the basal half rather stout, the distal half slender, rather clavate at the apex

and not dilated subapically. The inner peristomial tentacles are very stout, subconical, as long as the præstomials, transversely ringed; the outer peristomials have the undivided basal portion very long, as long as the head, the distal portions of about the same length, and in shape similar to the præstomials. Dorsal cirri rather short, of shape similar to that of the tentacles, but more distinctly clavate. The scale-tubercles are rather prominent. The elytra have the inner and posterior surface divided by narrow cuticular ribs into very irregular polygonal areas; anteriorly and externally the centres of these areas project as rounded elevations, and round the border these are succeeded by a series of very stout cylindrical "cilia." The ventral tubercles are inconspicuous. The ventral setæ are similar to those of *Thormora argus*, curved at the extremity, and subacute, with four teeth in each lateral row, the last tooth longer than the rest, triangular and acute: the dorsal setæ are very slender, like those of *Iphione ovata*, pinnate with broad lateral teeth. The body is almost colourless; the head red with black markings near the base of the tentacles.

A male and female of this species full of ripe sexual products were dredged in shallow water near Watson's Bay, Port Jackson, in the beginning of June.

Genus ANTINOË, Kinberg.

*Antinoë* (?) *grisea*.

*Antinoë* (?) *australis*, Baird, l. c., p. 193; *Polynoë grisea*, Quatrefages, l. c., p. 250; *Polynoë australis*, Schmarda, Neue Wirbellose Thierte, I., ii., p. 154.

The body is flat, 14 mm. long, 5 mm. broad, with 27 rings and 13 pairs of elytra. The back is reddish-yellow, the ventral surface yellowish-grey. The seven feelers are smooth, yellowish, and provided towards the end with a transverse black band. The elytra are bluish-grey; their surface is provided with scanty small elevations, visible only under high power; the borders

smooth. The attachment to the scale-tubercle is excentric; the form of the elytra is oval. The dorsal cirri are smooth; the ventrals small. The teeth of the dorsal setæ are curved, slender, and distant. In the neuropodium the setæ are of two kinds. Of these the one set are straight and have few but pointed teeth, pointed in opposite directions; the others are somewhat waved and broad, bear large three-cornered teeth only on one side, and have the apex divided into two teeth. (*Schmarda*).

Port Jackson (*Schmarda*).

I have not seen this species. The two forms of ventral setæ described and figured by *Schmarda* are evidently the same form viewed from two different sides.

#### *Antinoë WahlII.\**

*Antinoë WahlII*, Kinberg, l. c., p. 19, pl. vi., fig. 28; pl. x., fig. 55.

The body contains 36 or 37 segments with 14 pairs of elytra. The head is deeply divided, each lobe being slightly produced and pointed anteriorly. The anterior pair of eyes are placed close to the anterior angles. The mesial tentacle is fully twice the length of the head, papillose, with a slight swelling near the apex, and a terminal slender portion. The lateral præstomial tentacles are extremely short, not longer than the head, and slender, springing from below the apex of the cephalic lobes. The inner peristomial tentacles are as long as the mesial præstomial, stouter, pointed. the upper outer peristomials are rather longer than the inner, and of the same shape as the mesial tentacle; the lower are rather shorter. The elytra are delicate, not fringed, black behind, lighter in front with a circular black spot in the centre of the surface of attachment, and with small white dots in the posterior black portion; there is a band of very short papillæ near the outer border. The anal cirri are as long as the last eight segments.

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\* I have elsewhere previously referred to this species under the provisional name of *Polynoë myrtilicola*.



The ventral tubercles are not prominent. The ventral setæ are numerous, similar to those of *Thormora argus*, but with a subapical tooth. The dorsal setæ are about half the length of the ventral, stouter, slightly curved, with the appearance of a row of obscure serrations on the convex side produced by a series of transverse ridges. The colour is light reddish-yellow with short transverse grey bands on the dorsal surface; the head is purple; the tentacles are ornamented with blackish bands; the cirri are colourless.

Found among mussels both between tide marks and at a depth of 15 fathoms in Port Jackson.

*Antinoë præclara*, *sp. n.* (Pl. IX., figs. 10-12.)

The body contains 37 segments with 14 pairs of scales. The head is rather prominent, broadening slightly behind. The mesial tentacle is  $2\frac{1}{2}$  times the length of the head, ornamented with scattered cilia, and very slightly dilated near the apex. The outer præstomial tentacles are extremely short, not more than a third of the length of the mesial, and slender. The inner peristomials are as long as the mesial tentacle, stouter, pointed, not dilated near the apex and not ciliated. The outer peristomials are shorter than the inner, slightly dilated near the apex, and with a slender terminal portion. The parapodia are distinctly divided. The dorsal setæ, which are about twenty in number, are very slightly curved, and very slightly recurved at the extremity, which is subacute; on the convex side in the distal half are numerous transverse rows of minute and short spinules, or transverse ridges terminated by spinules, which only extend about half-way round the seta. The ventrals are of two kinds; the one kind are very much longer than the others, slender, subacute and almost imperceptibly arcuate, bidentate; on the concave aspect, in about its distal fifth, each seta is armed with two short longitudinal rows of alternating transverse combs of minute spinules, and on the convex side with a row of strong teeth; the other set of setæ are

strongly arcuate near the apex, and in the arched portion are armed with two rows of harpoon-like teeth which vary in size and degree of closeness in different setæ. The scale-tubercles are very prominent. The scales are imbricate and decussate, and are covered with short conical projections which at the border are produced into a few short filiform appendages or "cilia."

This species is found among mussels between tide-marks in Port Jackson. It is usually tolerably transparent; but sometimes the integument of the dorsal surface is rather thickly pigmented. Various points in the anatomy of this and the preceding species have been alluded to in the first part of this paper. *Antinoë ascidiicola*, *sp. n.* (Pl. IX., fig. 16.)

The body contains 37 segments bearing setæ. The head is large; the mesial tentacle is four times the length of the head, ciliated, slender, very slightly swollen near the extremity, the swelling being followed by a slender terminal portion. The lateral præstomials are scarcely half the length of the outer, tapering, ciliate; the cilia arranged in rows. Outer peristomials of similar shape to the mesial præstomials, rather longer, densely ciliate. The feet are divided, though not deeply. The setæ are similar to those of the preceding species. The dorsal cirri are long of the same shape as the præstomial tentacles, and, like the latter and the outer peristomials, brown with white tips; they are covered as in *A. præclara* and *A. Wahlîi*, with larger and smaller papillæ, mostly about  $\frac{1}{1000}$ th of an inch in length, but some two or three times that length, consisting of a slender cylindrical peduncle supporting a globular head. The ventral tubercles are distinct. The scale-tubercles are rather prominent; the elytra ovate, covered on the upper surface with minute conical or cylindrical processes, with a few cilia on the margin: along the margin are sometimes a few pear-shaped vesicles. The length is  $1\frac{1}{4}$  inch; the breadth  $\frac{1}{4}$  inch.

This species is somewhat nearly allied to the preceding, but the differences in the proportions of the tentacles and the number of the segments are constant. Both these species particularly *A. ascidiicola*, are characterised by their very great activity and the astonishing celerity of their movements, as well as the readiness with which, when irritated, they part with their elytra. Very numerous specimens of this species were found among the colonies of an *Ascidian* obtained with the trawl at the mouth of the Parramatta River. Allied to this species, though probably distinct, is one which occurs under stones near high-water mark in Port Jackson, and which is characterised by the thickness and density of its elytra. The head of this species (*A. pachylepis*) of which I have only seen one specimen, unfortunately mislaid, is represented in plate ix., fig. 17, and the minute structure of the elytra in plate x., fig. 1.

Genus POLYNOË, Savigny.

*Polynoë asterolepis*, *sp. n.* (Pl. X., figs. 3—7.)

There are 49 setiferous segments in the only specimen of this species which I have found, but several of the posterior segments have been lost. The head is large: the mesial tentacle is more than twice the length of the head, with a thick basal portion and acuminate at the extremity; the lateral præstomial tentacles are shorter than the mesial, and of similar shape. The inner peristomial tentacles are large and thick, extending beyond the extremity of the mesial tentacle, and are subacute; the outer peristomial tentacles are smaller than the inner, and of a shape similar to that of the præstomials. The parapodia are not divided, the notopodium being represented only by an aciculum. The ventral setæ are of two kinds, viz. (1) slender, curved setæ, provided with two rows of serrations (spines) in their distal portion, and (2) stouter setæ with the form of those of *Thormora argus*, but with a tooth near the apex. The scales, of which there

are 20 pairs, are imbricate and decussate; they are subcircular in outline, delicate and translucent, and not fringed. The colour is light brown, with the head purple, and a brownish-purple band along the centre of the body; on each scale is a circular brown mark irregularly bordered with black at the point of attachment, and numerous white dots scattered over the surface.

This species I found in the interstices of a specimen of *Tabipora* on Thursday Island, Torres Straits.

*Polynoë ochthœbolepis*, *sp. n.* (Pl. X, figs. 8—10, and Pl. XI., figs. 1—3.)

This species has an elongated form, there being fifty segments bearing parapodia. The præstomium is produced into two rounded lobes, and behind it on the dorsal surface of the peristomium are two pairs of rounded prominences. The unpaired tentacle is five times as long as the head, stout. and, like the cirri and paired tentacles, slightly swollen near the extremity, with a slender apical portion. The lateral præstomial tentacles are rather shorter and much more slender than the unpaired one; the peristomial tentacles are as long as the mesial. The peristomium has a pair of acicula. The parapodia are not divided, the dorsal branch being represented by a small tubercle with a few short setæ. The ventral setæ are similar somewhat to those of *Thormora argus*, but with a long tooth near the apex, and 15—17 spines in each lateral row. There are no dorsal setæ, the notopodium being only represented by a tubercle. The ventral tubercles are distinct. The scale-tubercles are prominent, with the surface of attachment longitudinally ovate. The elytra are decussate and imbricate throughout the entire length of the animal. They are irregularly ovate, thick-punctate, not fringed, with minute papillæ on the hinder portion, and are marked with oblique lines of dark purple. The length is about  $1\frac{1}{4}$  inch, and the breadth  $\frac{1}{4}$  inch.



Specimens of this species were dredged at a depth of 5 fathoms in Port Denison, and in Port Molle at 15 fathoms, during the cruise of H.M.S. "Alert" on the Queensland Coast.

The peristomium, as in many other species of *Polynoë*, is armed with an aciculum. The œsophagus exhibits, when retracted, a number of narrow longitudinal folds; the epithelium is thickly pigmented, and bears a strong resemblance to the hypoderm. The gizzard is extremely powerful; the teeth large, triangular and subacute. The intestinal walls exhibit a longitudinal folding of the mucous membrane, such as I have not noticed in any other species of *Polynoë*. The cæca are given off from the dorsal aspect of the intestine; a short neck leads into a tolerably spacious sac, which gives off upwards a branch ending under the dorsal integument, then curves towards the base of the parapodium, where it ends in the ventral portion of the cæcum. A pseudo-hæmal system is evident. In a female young ova were observed to be developing both around the cæca and round the ventral pseudohæmal trunk.

#### FAM. SIGALIONINA.

##### Genus *THALENESSA*, Baird.

*Thalenessa microceras*, *sp. n.* (Pl. XI., figs. 4—8.)

The only specimen of this species which I have obtained is incomplete, but contains over 70 segments. The head presents in front a very minute process, which seems to represent a mesial tentacle; behind are the two pairs of sessile eyes placed close together. The tentacular cirri consist each of a stout base or peduncle and two rami—a ventral and a dorsal—about equalling the peduncle in length, cylindrical and tapering; the peduncle presents near its base on the dorsal aspect, just in front of the mesial tentacle a minute conical appendage; at its distal extremity are a few fine setæ. Inserted close behind these are the extremely elongated, smooth, tapering buccal tentacles. The first pair of

parapodia extend far in front of the head; at their base, representing a tubercle, is a short globular protuberance with five short papillæ. They are biramous, the notopodium however, being very small. The neuropodium ends in a phylloid expansion and possesses a number of short filiform appendages; the compound setæ consist each of a straight peduncle serrated near the extremity, and a curved terminal appendage, articulated with the peduncle, and ending in a bifid cheliform apex. The notopodium has also a few filiform appendages; its setæ are very delicate and obscurely serrated. Just below the dorsal setæ on the dorsal aspect is a little button-like process. The ventral cirrus of the first parapodium is longer than the rest and placed at the base; the rest are very short and situated towards the middle of the ventral surface of the parapodium. The dorsal cirri are short, and the scale-tubercles are usually also slightly produced externally in the form of a cirriform appendage. The elytra are imbricate, but do not nearly meet across the back. They occur on every second segment; they are ovate, and delicate, with a fringe of quadrifid appendages on the outer border; the subcuticular squames are thickly pigmented along the inner border, the pigment being red in the preserved specimens.

Dredged at a depth of 15 fathoms in Port Mollé.

#### EXPLANATION OF PLATES.\*

##### Plate VI.

Fig. 1.—Intestinal cæcum of *Antinoë præclara*, seen from the dorsal aspect, magnified about 40 diameters. *a*, outline of intestine; *b*, opening of the cæcum into the intestine.

„ 2.—Green cells from the cæca of the *Polynoina*,  $\times 500$ .

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\* Through inadvertence, the numbers 6 and 7 have been repeated in the plates of this volume, the plate here numbered 6 being in reality the eighth.

Fig. 3.—Section through the nerve-cord and ventral body-wall of *Antinoë præclara*, magnified, showing the ventral pseudohæmal vessel (*a*), and the testicular follicles (*b, b*).

„ 4.—Subcuticular glands from the ventral integument of *Antinoë præclara*,  $\times 300$ .

„ 5.—Developing ova of *Thormora argus*.

Plate VII.

Fig. 1.—Head and anterior portion of the body of *Hermione brachyceras*, from the dorsal aspect, magnified. *a*, mesial tentacle; *c*, tentacular ventral cirri of the first somatic segment.

„ 2.—The same, from below in front. *a*, mesial tentacle; *b*, buccal tentacles; *c*, ventral cirri of the first somatic segment.

„ 3.—Setæ of the same  $\times 75$ ; *a*, ventral setæ; *b, c, d*, dorsal setæ.

„ 4.—Head of *Hermione (Aphrogenia) dolichoceras*, from below magnified. *a*, base of mesial tentacle; *b*, lateral tentacles; *c*, parapodium of first somatic segment.

„ 5.—Extremities of the tentacular cirri of the first segment of the same, more highly magnified; *a*, dorsal; *b*, ventral.

„ 6.—Dorsal setæ of the same,  $\times 200$ .

„ 7.—Ventral seta of the same.

„ 8.—Head and anterior portion of the body of *Triceratia aræoceras*, from below, magnified. *a*, præstomial tentacles; *b*, peristomial tentacles (buccal cirri); *c*, tentacular cirri.

„ 9.—Ventral seta of the same,  $\times 75$ .

„ 10.—Dorsal seta of the same,  $\times 75$ .

„ 11.—Section of the mucous membrane of the gizzard of the same,  $\times 375$ .

Fig. 12.—Section of the lower end of the gizzard of the same.

„ 13.—A portion of the mucous lining of the same, more highly magnified ( $\times 200$ ).

### Plate VIII.

Fig. 1.—Portion of section through the anterior region of the body of *Triceratia aræoceras*, magnified. *a*, nerve cord; *b*, ventral longitudinal muscles; *c*, neuropodium; *e*, dorsal longitudinal muscle; *f*, gizzard; *g*, necks of anterior gastric cæca surrounded by the generative products.

„ 2.—Section of the posterior region of the body of the same, magnified; *a*, nerve-cord; *b*, ventral longitudinal muscles; *c*, neuropodium; *d*, notopodium; *e*, dorsal longitudinal muscles; *f*, intestine; *g*, *g*, cæca.

„ 3.—Head and anterior portion of the body of *Lepidonotus lissolepis*, from above, magnified,

„ 4.—Ventral seta of the same  $\times 200$ .

„ 5.—Ventral seta of *Thormora argus*.

„ 6.—The same, lateral view; 6*a*, another form of the same.

„ 7.—Portion of dorsal seta of the same,  $\times 375$ .

„ 8.—One of the larger processes on the surface of the elytra of the same,  $\times 200$ .

„ 9.—Head of variety of *Thormora argus*, from Victoria, from above, magnified.

„ 10.—Ventral seta of the same,  $\times 200$ .

„ 11.—Dorsal seta of the same,  $\times 200$ .

„ 12.—Head and anterior portion of the body of the Port Jackson form of *Thormora argus*, from above magnified.

„ 13.—Head and anterior portion of the body of *Lepidonotus melanogrammus*, from above, magnified.



## Plate IX.

- Fig. 1.—Head of *Lepidonotus simplicipes*, from above, magnified.  
 „ 2.—Ventral seta of the same,  $\times 200$ .  
 „ 3.—Ventral seta of *Lepidonotus æololepis*,  $\times 375$ .  
 „ 4.—Dorsal seta of the same,  $\times 375$ .  
 „ 5.—A portion of the subcuticular layer of the elytra of the same,  $\times 500$ .  
 „ 6.—A portion of dorsal seta of *Lepidonotus torresiensis*,  $\times 375$ .  
 „ 7.—Ventral seta of *Lepidonotus dictyolepis*.  
 „ 8.—Portion of dorsal seta of the same.  
 „ 9.—Head of *Lepidonotus Jacksoni*, from above, magnified.  
 „ 10.—Head of *Antinoë præclara*, from above, magnified.  
 „ 11.—14.—Various forms of the ventral setæ of the same.  
 „ 15.—Dorsal seta of the same.  
 „ 16.—Head of *Antinoë ascidiicola*, from above, magnified.  
 „ 17.—Head of *A. pachylepis*.

## Plate X.

- Fig. 1.—Portion of one of the elytra of *Antinoë pachylepis*,  $\times 375$ .  
 „ 2.—Papilla from the dorsal cirri of the same,  $\times 500$ .  
 „ 3.—Head and anterior region of the body of *Polynoë asterolepis*, from above, magnified.  
 „ 4.—The same from below; the proboscis partly exerted.  
 „ 5, and 5a.—Ventral setæ of the same,  $\times 200$ .  
 „ 6.—Another form of the setæ of the same,  $\times 400$ .  
 „ 7.—Portion of one of the elytra of the same,  $\times 375$ .  
 „ 8.—Head and anterior portion of the body of *Polynoë ochthæbolepis*, from above, magnified.  
 „ 9.—The same from below.  
 „ 10.—Section through the anterior region of the body of the same, shewing the jaws. *a*, nerve-cord; *b*, *b*, ventral longitudinal muscles; *c*, neuropodium; *d*, notopodium; *e*, retracted oesophagus; *f*, *f*, teeth.

## Plate XI.

Fig. 1.—Section through the head and peristomium of *Polynoë ochthæbolepis*. *a*, cerebral ganglion; *b*, posterior eye; *c, g*, peristomial tentacles; *d*, bases of lateral præstomial tentacles; *e*, peristomial aciculum; *f*, parapodium of first segment; *h*, aperture of mouth.

Fig. 2.—Section of intestine of the same.

„ 3.—Ventral seta of the same,  $\times 400$ .

„ 4.—Head and anterior portion of the body of *Thalenessa microceras*, from above,  $\times 22$ .

„ 5.—The same, from below.

„ 6.—Ventral seta of the same.

„ 7.—Outline of elytron of the same, magnified.

„ 8.—Appendage from the border of the same,  $\times 200$ .

## CORRIGENDA.

The correct title of the paper by Dr. Williams, quoted on p. 257, is “Researches on the Structure and Homology of the Reproductive Organs of the Annelids.”

Page 251, lines 10 and 11, the word “another” should come in after “affords.”

## DESCRIPTION OF TWO NEW BIRDS FROM THE SOLOMON ISLANDS.

BY E. P. RAMSAY, F.L.S., &c.

## PHLOGÆNAS SALAMONIS.

Total length 11 inches; wing 6·5 inches; tail 4; tarsus 1·3; bill from the forehead 1, from the nostril 0·5, from the angle of the mouth 1·1 inch. Bill brown, legs and feet carmine. The bill is strong and much curved at the tip; the tail rounded, of twelve feathers. General colour reddish chocolate-brown above, slightly tinted with rich metallic violet-purple, which becomes very bright on the wing-coverts, and interscapular region; the primaries and secondaries, and the inner webs of the tail-feathers and their under surfaces, dull dark brown; head chocolate colour